REMARKS

The applicants appreciate the careful examination the Examiner has given to this application and believe the claims as amended will satisfy the Examiner's concerns.

Claim 1 has been amended to introduce limitations of both original claims 2 and 15. As a result, the amended claim 1 formulates the invention more precisely, and clearly differentiates it from the cited prior art of Kawai (or Gillett)

Namely, the invention provides on-going forward error correction (FEC) of the transmitted data, monitoring a raw bit error rate (BER) before the FEC, determining a derivative of the raw BER (or a second derivative of error count of raw data) and calculating a predicted raw BER based on said derivative, and making a switching decision based on the predicted raw BER.

Please note that the BER is a derivative itself, it is a derivate of error count, which is described e.g. in the paragraph "Col 1, lines 62-66" of Kawai cited by the Examiner.

The derivative of the BER (mentioned in the amended claim 1) will be a second derivative of error count, which is not mentioned or suggested in any of the cited references.

In addition, the amended claim provides the measurement of the raw BER, which is before the error correction, and makes switching decision based on the raw measurements of the BER and the derivative of the BER.

In contrast, the cited prior art determines a BER of the output data, which is after the error correction, and makes switching decision based thereon. It also does not take into account the rate of change of the BER (i.e. the BER derivative)

Independent claims 17 and 21 have been amended similar to the amended claim 1.

Other amended or original claims depend on claim 1, 17 or 21 and introduce further limitations to these claims.

Accordingly, the Applicants believe that the Examiner's rejections under 102(b) (Kawai, Gillett) and under 103(a) (Kawai, Gillett in view of Tanaguchi) have been overcome.

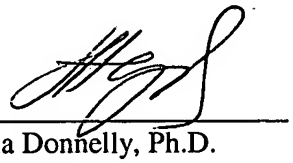
Please note that claims have been amended to exclude the term "immediate future" to overcome the $112 rejection.

Minor typographical errors have been corrected in the technical description section on page 14, equations (1), (2) and (4).

The Examiner is requested to respectfully reconsider this application with regard to the amendments to the claims presented above and the above arguments with a view to considering the claims favorably for allowance.

The Commissioner is hereby authorized to deduct any prescribed fees for these amendments, if required, from our Company's **Deposit Account No. 501832**.

Yours truly,
Richard Charles Vieregge



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In a modification to the above-described embodiments of the invention, the failure predictor block 22 can process the quality measures from the quality determination block 20 by using a predictive mechanism based on defining derivatives of BERs. The block 20 measures an initial BER_0 value when the system is set up, and stores the value in a memory of the block 22. The control circuit of the block 20 continues to measure BER at periodic time intervals (i.e. ... t_{n-2}, t_{n-1}, t_n ...), stores the corresponding values of BERs (BER_{n-2}, BER_{n-1}, BER_n, ...) in the memory, and sends the stored value to the failure predictor block 22. At each time interval (t_n) the control circuit of the predictive block 22 calculates a deviation of the current BER from the initial BER_0:

$$\Delta_{n-1} = BER_{n-1} - BER_0 \qquad (1)$$

$$\Delta_n = BER_n - BER_0 \qquad (2)$$

The control circuit also calculates a speed of BER change by taking a derivative from the BER deviations and predicts a BER_{n+1} at the next time interval (t_{n+1}):

$$D_n = \frac{\Delta_n - \Delta_{n-1}}{t_n - t_{n-1}} \qquad (3)$$

$$BER_{n+1} = BER_n + D_n \cdot (t_n - t_{n-1}) \qquad (4)$$

The predicted BER_{n+1} is compared with a predetermined threshold value. If the amplitude of the predicted BER_{n+1} is greater than the predetermined threshold value, the control circuitry of the predictor block 22 generates a signal to switch to a protection path through the network. In other variations, at least one second or higher order derivative may be used.

In a modification to the above-described embodiments of the invention, the failure predictor block 22 can process the quality measures from the quality determination block 20 by using a predictive mechanism based on defining derivatives of BERs. The block 20 measures an initial BER_0 value when the system is set up, and stores the value in a memory of the block 22. The control circuit of the block 20 continues to measure BER at periodic time intervals (i.e. ... t_{n-2}, t_{n-1}, t_n ...), stores the corresponding values of BERs (BER_{n-2}, BER_{n-1}, BER_n, ...) in the memory, and sends the stored value to the failure predictor block 22. At each time interval (t_n) the control circuit of the predictive block 22 calculates a deviation of the current BER from the initial BER_0:

~~$\Delta_{n-1} = BER_{n-1} - BER_0$ (1)~~

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The control circuit also calculates a speed of BER change by taking a derivative from the BER deviations and predicts a BER_{n+1} at the next time interval (t_{n+1}):

$$D_n = \frac{\Delta_n - \Delta_{n-1}}{t_n - t_{n-1}} \qquad (3)$$

~~$BER_{n+1} = \Delta_n + D_n \cdot (t_n - t_{n-1})$ (4)~~

$$BER_{n+1} = BER_n + D_n \cdot (t_n - t_{n-1}) \qquad (4)$$

The predicted BER_{n+1} is compared with a predetermined threshold value. If the amplitude of the predicted BER_{n+1} is greater than the predetermined threshold value, the control circuitry of the predictor block 22 generates a signal to switch to a protection path through the network. In other variations, at least one second or higher order derivative may be used.

AMENDEMENTS TO THE CLAIMS

WE CLAIMS:

1 (Currently amended) A method of performing protection switching in a communications network, the method comprising:

a) on an ongoing basis, providing forward error correction (FEC) coding for data transmitted on the communications network and monitoring ~~a raw quality measure~~ a raw bit error rate (BER) determined prior to performing the error correction based on the FEC coding in respect of a first path through the communications network;

b) on an ongoing basis, ~~deciding on the basis of the quality measure whether a failure on the first path is likely to occur in the immediate future~~ determining a first order derivative of said raw BER based on at least one previous raw BER and a current raw BER;

(c) determining a predicted raw BER at a next time interval based on the current BER and said first order derivative; and

(d) ~~after deciding a failure is likely to occur in the immediate future but before occurrence of a failure,~~ comparing the predicted BER with a predetermined threshold, and if the predicted raw BER is exceeding the threshold, instigating a switch to a protection path through the network.

2 (Canceled) ~~A method according to claim 1 further comprising:~~

~~providing forward error correction coding for data transmitted on the communications network;~~

~~wherein the raw quality measure is a raw bit error rate (BER) determined prior to performing error correction based on the forward error correction coding.~~

2a. (New) A method as described in claim 1, wherein the step (b) further comprises determining a second order derivative of the raw BER based on the previously measured raw BERs and the current raw BER, and the step (c) comprises determining the predicted raw BER at the next time interval based on the current BER and said first and second order derivatives.

2b. (New) A method as described in claim 2a, wherein the step (b) further comprises determining at least one third or higher order derivative of the raw BER based on the previously measured raw BERs and the current raw BER, and the step (c) comprises determining the predicted raw BER at the next time interval based on the current BER and said derivatives.

3 (Currently amended) A method according to claim 1 wherein the first path is a path for a wavelength channel through an optical network.

4 (Canceled) ~~A method according to claim 1 wherein deciding on the basis of the quality measure whether a failure is likely to occur in the immediate future comprises comparing the quality measure to a threshold.~~

5 (Currently Amended) A method according to claim 1 wherein the step (c) ~~deciding on the basis of the quality measure whether a failure is likely to occur in the immediate future~~ comprises determining if the ~~quality measure~~predicted BER crosses two thresholds within a time shorter than a predetermined time.

6 (Canceled) ~~A method according to claim 1 wherein deciding on the basis of the quality measure whether a failure is likely to occur in the immediate future comprises comparing the quality measure to a threshold, and if the quality measure exceeds the threshold, also analyzing previous quality measures to decide whether the quality measure exceeding the threshold is likely an ongoing condition which is likely to stabilize, or a condition which will likely result in a failure in the immediate future.~~

7 (Canceled) ~~A method according to claim 6 wherein analyzing previous quality measures to decide whether the quality measure exceeding the threshold is likely an ongoing condition which is likely to stabilize, or a condition which will likely result in a~~

~~failure in the immediate future comprises determining if previous readings have changed by greater than a predetermined amount.~~

8 (Canceled) ~~A method according to claim 1 further comprising completing the switch to the protection path before failure of the first path.~~

9 (Currently amended) A method according to claim 1 wherein the protection path is a path available for a wavelength channel. ~~to be made available for protection switching for multiple channels.~~

10 (Original) A method according to claim 1 wherein the protection path is a dedicated path for the first path.

11 (Original) A method according to claim 1 wherein:

instigating a switch to a protection path through the network is done for higher priority traffic before being done for lower priority traffic.

12 (Currently amended) A method according to claim 1 wherein the ~~quality~~raw BER measure in respect of ~~a~~the first path through the communications network comprises a BER measurement for each of ~~at least one~~the light paths making up the first path.

13 (Currently amended) A method according to claim ~~2~~1 further comprising making connection routing decisions for new connection requests taking into consideration raw bit error rates collected for the network in a manner which encourages the use of links/paths with good raw BER over links/paths with poor raw BER.

14 (Canceled) ~~A method according to claim 1 wherein the raw quality measure is a function of one or more raw quality measures taken for light sections forming part of said path.~~

15 (Canceled) ~~A method according to claim 2 wherein deciding on the basis of the raw quality measure whether a failure is likely to occur in the immediate future comprises:~~

~~determining a first order derivative based on at least one previous raw BER and a current raw BER;~~

~~predicting a predicted raw BER at a next time interval based on the current BER and the derivative; and~~

~~deciding a failure is likely to occur in the immediate future if the predicted raw BER is greater than a predetermined threshold value.~~

16 (Canceled) ~~A method according to claim 2 wherein deciding on the basis of the raw quality measure whether a failure is likely to occur in the immediate future comprises:~~

~~determining at least one second or higher order derivative based on one or more previously measured raw BERs and a current raw BER;~~

~~predicting a predicted raw BER at a next time interval based on the current BER and the at least one second or higher order derivative;~~

~~deciding a failure is likely to occur in the immediate future if the predicted raw BER is greater than a predetermined threshold value.~~

17 (Currently amended) A method of performing protection switching in an optical communications network, the method comprising:

a) on an ongoing basis, providing forward error correction (FEC) coding for data transmitted on the communications network and monitoring a raw bit error rate (BER) determined prior to performing the error correction based on the FEC coding in respect of a first light path between components in an optical communications network;

b) on an ongoing basis, determining a first order derivative of said raw BER based on at least one previously measured raw BER and a current raw BER;

(c) determining a predicted raw BER at a next time interval based on the current BER and said first order derivative; and

d) comparing the predicted BER with a predetermined threshold, and if the predicted raw BER is exceeding the threshold, instigating a switch to a protection link through the network, and switching at least one service from the first light path to the protection light path. ~~monitoring a raw BER in respect of a first light path between components in an optical communications network;~~

~~b) on an ongoing basis, deciding on the basis of the raw BER whether a failure on the first light path is likely to occur in the immediate future;~~

~~c) after deciding a failure is likely to occur in the immediate future but before occurrence of a failure, instigating a switch to a protection link through the network, and switching at least one service from the first light path to the protection light path.~~

17a.(New) A method as described in claim 17, wherein the step (b) further comprises determining a second order derivative of the raw BER based on the previously measured raw BERs and the current raw BER, and the step (c) comprises determining the predicted raw BER at the next time interval based on the current BER and said first and second order derivatives.

17b. (New) A method as described in claim 17a, wherein the step (b) further comprises determining at least one third or higher order derivative of the raw BER based on the previously measured raw BERs and the current raw BER, and the step (c) comprises determining the predicted raw BER at the next time interval based on the current BER and said derivatives.

18 (Original) A method according to claim 17 wherein instigating a switch to the protection light path is done in a sequence based on priority of the services.

19 (Original) A method according to claim 17 further comprising making connection routing decisions for new connection requests taking into consideration raw bit error rates collected for the network in a manner which encourages the use of paths/light paths with good raw BER over paths/light paths with poor raw BER.

20 (Canceled) ~~A method according to claim 17 wherein the raw quality measure is a function of one or more raw quality measures taken for light sections forming part of said light path.~~

21 (Currently amended) A network node comprising:

———an input for receiving on an ongoing basis raw BER measurements in respect of a path through a network of which the network node forms a part; and

a ——decision means adapted to, on an ongoing basis, to determine a first order derivative of said raw BER based on at least one previous raw BER and a current raw BER, to determine a predicted raw BER at a next time interval based on the current BER and said first order derivative, and to instigate a switch to a protection path through the network if the predicted raw BER is exceeding a threshold.

~~decide on the basis of the raw BER measurements whether a failure on the path is likely to occur in the immediate future, and after deciding a failure is likely to occur in the immediate future but before occurrence of the failure to instigate a switch to a protection path through the network.~~

22 (Currently amended) A network node according to claim 21 adapted for use in an optical network, wherein the first path is a path for a wavelength channel through an optical network.

23 (Canceled) ~~A network node according to claim 22 further adapted to complete the switch to the protection path before failure of the first path.~~

24 (Original) A network node according to claim 21 adapted to transmit traffic of differing priorities on said path, and adapted to instigate a switch to a protection path through the network for higher priority traffic before doing so for lower priority traffic.

25 (Original) A network node according to claim 21 wherein the raw BER measurements comprise a BER measurement for each link making up the first path.

26 (Original) A network node according to claim 21 further comprising:

a network routing component adapted to make connection routing decisions in respect of new connection requests, the network routing component being adapted to take into consideration the raw bit error rates collected for the network in a manner which paths/light paths with poor raw BER.